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CITY OF HAMILTON, ONTARIO  
SEWAGE TREATMENT PLANT  
PROTECTION TO

PROCTOR & REDFERN  
TORONTO — CANADA





CITY OF HAMILTON, ONTARIO  
SEWAGE TREATMENT PLANT  
PROTECTION TO  
CHLORINE RECEIVING FACILITIES





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INTRODUCTION

The Chlorine Receiving Facilities for the Sewage Treatment Plant in the City of Hamilton, Ontario, are located near the C.N.R. main line at Nash Road. The Receiving Facilities are over a mile distant from the Sewage Treatment Plant proper.

Over the past months your City has been investigating the staff requirements for the Sewage Treatment Plant. We understand that the City does not anticipate having a man at the Chlorine Receiving Facilities at all times.

Naturally, the City is concerned with trespassers entering the remote property, and with vandalism. Furthermore, the City is worried over the possible danger of chlorine escaping from say, a chlorine tank car, in the area of the Chlorine Receiving Facilities to the atmosphere which could go unnoticed by the staff at the Sewage Treatment Plant.

When considering the possibilities of leaking chlorine, it must be remembered that chlorine tank cars and other chlorine handling and dispensing equipment, is equipment of proven reliability and is equipped with the ultimate in safety devices to prevent the accidental escape of chlorine gas. Over the past many years, notwithstanding



an ever-increasing use throughout the world of chlorine both in industry and elsewhere, the accidental escape of chlorine is virtually unknown. Nevertheless, remembering the sinister reputation history has given to chlorine gas and recalling the recent chlorine accident near Cornwall, Ontario, the concern over the possibility of the unnoticed escape of chlorine gas is understandable.

As an outcome to these concerns we were instructed by Mr. W. A. Wheten, P.Eng., City Engineer and Manager of Water Works, to report upon the feasibility and the cost of providing an intruder alarm system and a chlorine detection alarm system for the Chlorine Receiving Facility.

### THE INTRUDER ALARM SYSTEM

We have discussed the provision of an intruder alarm system to the Chlorine Receiving Facility with a number of specialist companies who provide, install and maintain such protective systems.

All the intruder alarm systems investigated made use of a light beam projected on to a photo electric cell; an interruption of the beam triggers the alarm system.

To protect the Chlorine Receiving Facilities from intruders we recommend establishing a "fence" of photo electric beams to form a square enclosing the chlorine building and the area where the railroad chlorine tank cars will stand. Each side of the square would







be approximately 75 feet in length. The beam "fence" would be inside the existing chain link fence on three sides of the square; the beam "fence" would cross the spur railway track at right angles on the fourth side.

To give additional protection we recommend that each side of the beam "fence" consists of two photo electric beams - a lower beam and an upper beam. The lower and upper beams would be so located as to prevent an intruder crawling under a beam or jumping over a beam.

The breaking of a beam by any person or object would automatically trip an alarm located in the office of the superintendent at the Sewage Treatment Plant. It is recommended that the alarm at the Sewage Treatment Plant be two-fold, namely visual by means of a red light and audible by means of a bell or horn. On the tripping of the alarm at the Sewage Treatment Plant men could be dispatched at once to the Chlorine Receiving Facility to determine the cause.

A prominent specialist company supplying, installing, and servicing such intruder protection devices is the Dominion Electric Protection Company of 36 James Street South, Hamilton, Ontario. After reviewing the offerings and the backgrounds of certain other companies in this field we are left with the impression that the Dominion Electric Protection Company are to be highly recommended.



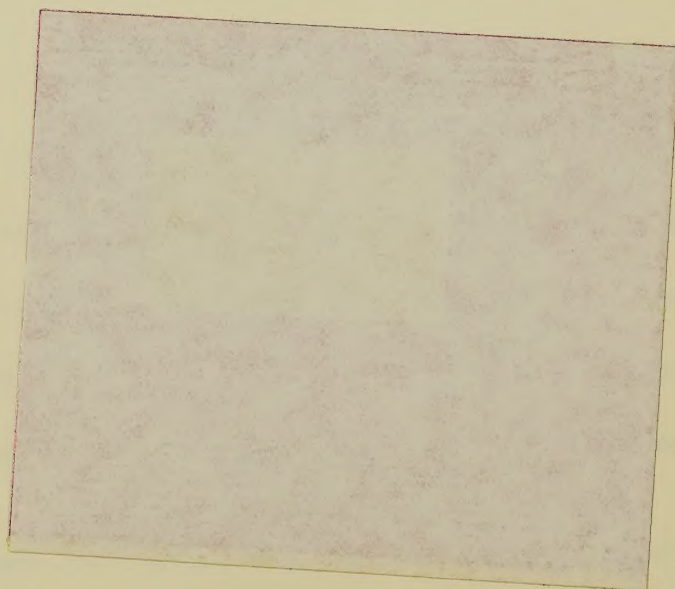


The Dominion Electric Protection Company provides an additional service. For an annual service charge the Dominion Electric Protection Company will also terminate an alarm in their central office in Hamilton. Thus, when a beam is cut and the alarm is triggered, not only is an alarm given at the Sewage Treatment Plant, it is also given in the central office of the Dominion Electric Protection Company. Their alarm board is manned at all times; if, after a given time, no obvious action has been taken by others in investigating the cause of the triggering of the alarm, the Dominion Electric Protection Company would contact the Sewage Treatment Plant by phone to enquire as to the causes for the delay and, if need be, actually send their man down to the Chlorine Receiving Facility to investigate.

We were concerned with the possibility that the beam "fence" would be ineffective during foggy weather. However, we have been convinced that it would require a particularly dense fog to make the system inoperative and, furthermore, that the incident of such fogs is low enough for us not to be concerned on this account.

We find that the proposed equipment has been fully tested and is completely weatherproof.

It is realized that it will be necessary to "break" the fence at certain times to operate the Chlorine Receiving Facility. For example, when a tank car is entering the Receiving Facility Siding or





when plant personnel enter the Facility for housekeeping and servicing purposes the beam "fence" must be broken. We propose, therefore, to permit a bona-fide employee to be able to switch off the beams during the time he is in the Facility and to re-set the beams after the finish of his work. In order that the cause of such a planned interruption is known at the Sewage Treatment Plant and at the central office of Dominion Electric Protection Company, it would be necessary for the employee to phone the plant and the Dominion Electric Protection Company prior to breaking and after re-setting the beam. Furthermore, if the beam is not re-set after a reasonable time it would behove the Sewage Treatment Plant Superintendent and Dominion Electric Protection Company to phone the Chlorine Receiving Facility to determine the reasons for the prolonged outage.

Since it may not be desirable to have the audio alarm sounding continuously when the beams have been cutout or interrupted, it will be necessary to have a local switch at the Sewage Treatment Plant for cutting out the audio alarms when necessary.

### CHLORINE DETECTION PROTECTION

There are two acceptable devices on the market for the detection of chlorine gas.

In the first device, by means of a small blower, samples of air are drawn in and over sensitized paper. Light is directed on the paper and the light beam is reflected to a photo electric cell. If





there is chlorine present in the air samples the colour of the sensitized paper changes and, with this change, there is an alteration in its light reflecting quality. The change in reflecting ability alters the amount of light directed to the photo electric cell, thus giving a change in the electrical output from the cell. This change in electrical output is used to trigger the alarm device.

In the second type of chlorine detection device, the blower draws samples of the air through distilled water. The distilled water forms part of a balanced electric bridge. When chlorine is present it dissolves in the water of the cell, changes the resistance of the cell and so unbalances the electric bridge. The unbalancing of the electric bridge is made to actuate an alarm or other device.

The system using sensitized paper has the disadvantage that the paper must be inspected and changed daily. Such daily inspection is not necessary with the unit using a water cell. Furthermore, the unit using a water cell has certain theoretical advantages. Unfortunately, there are no known installations of the water cell unit on chlorine detection. On the other hand, the sensitized paper device has been in field use for some 12 years - there are a number of installations in the Toronto area. Because it is important that a chlorine detection device be field proven rather than theoretically attractive, we would recommend the use of the sensitized paper device.

The sensitized paper device is marketed and serviced in Canada by Wallace & Tiernan Limited of 925 Warden Avenue, Toronto.





We would recommend that samples of air be gathered from the area to the east and from the area to the west of the building directly over where a chlorine tank car could stand in its sidings during unloading. By means of an air transfer valve, it would be possible to use but a single chlorine detection unit for receiving the samples of air from both air sampling intake points. This would mean that when the chlorine concentration in the atmosphere is high enough to actuate the detection device and so to sound the alarm, no indication would be given as to which of the two air sampling points is responsible. However, this would be of no importance.

Chlorine is highly soluble in water. We felt that advantage could be taken of this physical fact to provide an additional safety feature in the case of an accidental escape of chlorine gas. We envisaged the chlorine detection device being used to trigger spray nozzles directing a spray of water downwards over the tank cars in the vicinity of the air sampling intakes. Unfortunately, chlorine water is highly corrosive. We believe now that such a feature would be more of a potential danger rather than an additional safety feature in that corrosion could aggravate a leak, making a minor leak into a major one.

### RECOMMENDATIONS

We recommend that intruder protection be provided by the following:



1. Provide a "fence" of light beams to enclose an area approximately 70 feet square around the chlorination facility building. Each side of the beam fence to consist of two beams.

2. That the protection system be purchased through the Dominion Electric Protection Company of 36 James Street South, Hamilton, Ontario.

3. That the alarm system from the protection device terminate in the office of the superintendent at the Sewage Treatment Plant and also terminate in the central office of the Dominion Electric Protection Company.

Furthermore, we recommend that chlorine gas protection should be provided by the following:

1. By providing and installing a chlorine detection device in the Chlorine Facility Building. The device will sample the air above the railway siding immediately to the east of the building and the air immediately above the siding to the west of the building.

2. The chlorine detection device be purchased and serviced by Wallace and Tiernan Limited, 925 Warden Avenue, Toronto.

3. The chlorine detection device to be tied in to the alarm system associated with the intruder protection. Thus, on a chlorine detection device being triggered an alarm would sound both in the Sewage Treatment Plant and at the office of the Dominion Electric Protection Company.





We estimate the cost of the intruder and chlorine gas detection device as given in the "Recommendations" above, as follows:

(a) Capital Costs

- i) Provision and installation of intruder protection device at the chlorine unloading facility .....\$ 3,200.
- ii) Chlorine detection device installed .....\$ 2,900.
- iii) Audio and Visual alarms at the Sewage Treatment Plant ..... \$ 1,200.
- Total ..... \$ 7,300.
- Engineering and Contingencies ..... \$ 2,500.
- \$ 9,800.

(b) Operating Costs

- i) Bell Telephone line charges from the chlorine unloading facility to the Sewage Treatment Plant ..... \$ 40. per yr.
- ii) Annual service charge on intruder protection equipment including tie to their central office ..... \$760. per yr.
- iii) Service on chlorine protection equipment ..... \$150. per yr.
- Total Annual Costs ..... \$950. per yr.

Yours very truly,

PROCTOR & REDFERN,

*C. S. Dutton*

C. S. Dutton, P. Eng.









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